

## General

### Guideline Title

Nutritional support after spinal cord injury. In: Guidelines for the management of acute cervical spine and spinal cord injuries.

### Bibliographic Source(s)

Dhall SS, Hadley MN, Aarabi B, Gelb DE, Hurlbert RJ, Rozzelle CJ, Ryken TC, Theodore N, Walters BC. Nutritional support after spinal cord injury. In: Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery. 2013 Mar;72(Suppl 2):255-9. [27 references] [PubMed](#)

### Guideline Status

This is the current release of the guideline.

## Recommendations

### Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendations (Level I-III) are defined at the end of the "Major Recommendations" field.

#### Recommendations

##### Level II

- Indirect calorimetry as the best means to determine the caloric needs of spinal cord injury (SCI) patients is recommended.

##### Level III

- Nutritional support of SCI patients is recommended as soon as feasible. It appears that early enteral nutrition (initiated within 72 hours) is safe, but has not been shown to affect neurological outcome, the length of stay, or the incidence of complications in patients with acute SCI.

#### Summary

Alterations in metabolism occur after acute SCI, but the marked hypermetabolic response seen after acute traumatic brain injury appears to be blunted in SCI patients by the flaccidity of denervated musculature after spinal cord transection/injury. As a result, resting energy expenditure (REE) is lower than predicted after acute SCI. Equation estimates of REE in these patients have proven to be inaccurate. Comparative Class II medical evidence supports the use of indirect calorimetry as the recommended technique to assess energy expenditure in both the acute and chronic settings among patients with SCI.

Protein catabolism does occur after acute, severe SCI, and marked losses in lean body mass due to muscle atrophy result in huge nitrogen losses,

prolonged negative nitrogen balance, and rapid weight loss. Nutritional support of the SCI patient to meet caloric and nitrogen needs, not to achieve nitrogen balance, is safe and may reduce the deleterious effects of the catabolic, nitrogen wasting process that occurs after acute SCI. It appears that early enteral nutrition (initiated within 72 hours) is safe, but has not been shown to affect neurological outcome, the length of stay, or the incidence of complications in patients with acute SCI.

#### Definitions:

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question<sup>a</sup>

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
I	High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\bar{A}$ , statistic $\geq 0.60$ or an intraclass correlation coefficient of $\geq 0.70$
	Systematic review <sup>b</sup> of Class I randomized controlled trials (and study results were homogeneous <sup>c</sup> )	Systematic review <sup>b</sup> of Class I studies	
II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\bar{A}$ , statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
	Prospective <sup>d</sup> comparative study <sup>e</sup>	Systematic review <sup>b</sup> of Class II studies	
	Systematic review <sup>b</sup> of Class II studies or Class I studies with inconsistent results	Study of nonconsecutive patients; without consistently applied reference "gold" standard	
	Case-control study <sup>g</sup>	Systematic review <sup>b</sup> of Class III studies	
	Retrospective <sup>f</sup> comparative study <sup>e</sup>	Case-control study	
	Systematic review <sup>b</sup> of Class II studies		
III	Case series <sup>h</sup>	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a $\bar{A}$ , statistic of <0.40 or an intraclass correlation coefficient of <0.50
	Expert opinion	Expert opinion	

<sup>a</sup>A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

<sup>b</sup>A combination of results from 2 or more prior studies.

<sup>c</sup>Studies provided consistent results.

<sup>d</sup>Study was started before the first patient enrolled.

<sup>e</sup>Patients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

<sup>f</sup>The study was started after the first patient was enrolled.

<sup>g</sup>Patients identified for the study on the basis of their outcome, called "cases" (e.g., failed fusion), are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

<sup>h</sup>Patients treated 1 way with no comparison group of patients treated in another way.

## Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
Level III	Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)

## Clinical Algorithm(s)

None provided

## Scope

### Disease/Condition(s)

Hypermetabolism, catabolism and accelerated nitrogen losses following spinal cord injury

### Guideline Category

Evaluation

Management

### Clinical Specialty

Critical Care

Neurological Surgery

Neurology

Nutrition

Orthopedic Surgery

### Intended Users

Advanced Practice Nurses

Dietitians

Physician Assistants

Physicians

### Guideline Objective(s)

To update the medical evidence on nutritional support after spinal cord injury (SCI) since the original publication

## Target Population

Patients with acute spinal cord injuries (SCIs)

## Interventions and Practices Considered

1. Indirect calorimetry to determine caloric needs
2. Early enteral nutrition initiated within 72 hours

## Major Outcomes Considered

- Incidence of infection
- Nutritional status
- Feeding complications
- Respiratory complications
- Number of ventilator hours
- Length of stay
- Resting energy expenditure
- Nitrogen loss
- Neurological outcome

## Methodology

### Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

#### Search Criteria

A National Library of Medicine (PubMed) computerized literature search from 1966 to 2011 was undertaken using Medical Subject Headings in combination with "spinal cord injury": "nutrition" (138 citations) and "nutritional support" (73 citations). Non-English language and duplicate citations were deleted. Titles and abstracts of the remaining publications were reviewed. A focused search on the specific issue of nutrition and human patients with acute spinal cord injuries (SCI) identified 16 citations. Relevant manuscripts and reviews describing nutritional support of head-injured patients and several reports describing the nutritional status of chronic SCI patients are included in the bibliography. These efforts identified 7 Class III medical evidence studies, which describe metabolism, nitrogen wasting and the effect of feeding on nitrogen balance, and serum biochemistries in patients after acute SCI. Four of the 7 citations offer Class II medical evidence on indirect calorimetry to assess energy expenditure after SCI. There were no studies that examined the effects of nutritional support on neurological outcome following acute SCI.

### Number of Source Documents

Seven Class III medical evidence studies are summarized in Evidentiary Table format (see the table in the original guideline document).

### Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

# Rating Scheme for the Strength of the Evidence

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question<sup>a</sup>

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## Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

## Description of the Methods Used to Analyze the Evidence

Selected articles were carefully reviewed by the authors. An evidentiary table was created (refer to the table in the original guideline document) that reflected the strengths and weaknesses of each article.

On occasion, the assessed quality of the study design was so contentious and the conclusions so uncertain that the guideline authors assigned a lower medical evidence classification than might have been expected without such a detailed review. In every way, adherence to the Institute of Medicine's criteria for searching, assembling, evaluating, and weighing the available medical evidence and linking it to the strength of the recommendations presented in this document was carried out.

Articles that did not achieve immediate consensus among the author group were discussed extensively until a consensus was reached. Very few contributions required extensive discussion. Most articles were easily designated as containing Class I, II, or III medical evidence using the criteria set forth by the author group at the initiation of the literature evaluation process (see the "Rating Scheme for the Strength of the Evidence" field).

## Methods Used to Formulate the Recommendations

Expert Consensus

## Description of Methods Used to Formulate the Recommendations

The current author group was selected for its expertise in spinal surgery (both neurosurgical and orthopedic), neurotrauma, clinical epidemiology, and, in several cases, prior experience with guideline development. The topics chosen for inclusion in this iteration of these guidelines are contemporary and pertinent to the assessment, evaluation, care, and treatment of patients with acute cervical spine and/or spinal cord injuries.

## Rating Scheme for the Strength of the Recommendations

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
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## Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

## Method of Guideline Validation

Not stated

## Description of Method of Guideline Validation

Not applicable

## Evidence Supporting the Recommendations

## Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

The potential benefits of enteral feeding over parenteral delivery include maintenance of gut integrity and function, reduced expense, lower risk of infection and avoidance of intravenous catheter-related complications. Nasoduodenal or nasojejunal feeding tubes usually allow full caloric, high-nitrogen, high-volume feeding within days of injury.

### Potential Harms

In a published retrospective study of a group of 33 patients who received enteral feeding at a median of 2 days (range 0.5-4.8 days) following admission, the most common reason for interruption of enteral feeds was high gastric aspirates, which occurred in 67% of patients. Two patients developed ileus, requiring conversion from nasogastric to nasojejunal feeding tubes.

## Qualifying Statements

### Qualifying Statements

- Medical evidence-based guidelines are not meant to be restrictive or to limit a clinician's practice. They chronicle multiple successful treatment options (for example) and stratify the more successful and the less successful strategies based on scientific merit. They are not absolute, "must be followed" rules. This process may identify the most valid and reliable imaging strategy for a given injury, for example, but because of regional or institutional resources, or patient co-morbidity, that particular imaging strategy may not be possible for a patient with that injury. Alternative acceptable imaging options may be more practical or applicable in this hypothetical circumstance.
- Guidelines documents are not tools to be used by external agencies to measure or control the care provided by clinicians. They are not medical-legal instruments or a "set of certainties" that must be followed in the assessment or treatment of the individual pathology in the individual patients we treat. While a powerful and comprehensive resource tool, guidelines and the recommendations contained therein do not necessarily represent "the answer" for the medical and surgical dilemmas faced with many patients.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

### Implementation Tools

Mobile Device Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

## Institute of Medicine (IOM) National Healthcare Quality Report

# Categories

## IOM Care Need

Getting Better

## IOM Domain

Effectiveness

# Identifying Information and Availability

## Bibliographic Source(s)

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## Adaptation

Not applicable: The guideline was not adapted from another source.

## Date Released

2013 Mar

## Guideline Developer(s)

American Association of Neurological Surgeons - Medical Specialty Society

Congress of Neurological Surgeons - Professional Association

## Source(s) of Funding

Congress of Neurological Surgeons

## Guideline Committee

Guidelines Author Group of the Joint Section of Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons

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## Financial Disclosures/Conflicts of Interest

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this guideline.

## Guideline Status

This is the current release of the guideline.

## Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the [Neurosurgery Web site](#)

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## Availability of Companion Documents

The following are available:

- Foreword. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):1. Electronic copies: Available in Portable Document Format (PDF) from the [Neurosurgery Web site](#) .
- Commentary. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):2-3. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .
- Introduction to the guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):5-16. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .
- Methodology of the guidelines for management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):17-21. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .

## Patient Resources

None available

## NGC Status

This NGC summary was completed by ECRI Institute on July 9, 2013. The information was verified by the guideline developer on October 3, 2013.

## Copyright Statement

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